

USE OF CONSERVED WATER FOR FOOD PRODUCTION—  
WITH PARTICULAR REFERENCE TO  
VICTORIA AND AUSTRALIA

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Australia now has three million acres of land under irrigated culture. However, this is only about  $\frac{1}{2}\%$  of the land under irrigation in the world; it is less than 0.2% of the area of Australia, and the water used on this land is but  $1\frac{1}{2}\%$  of the total flow of all Australian rivers.

Pastures occupy two-thirds of our irrigated land. By world standards, this is an inferior form of water use. There are, of course, good reasons for the development of irrigated pastures in Australia and these may be summarized briefly as follows: poor soils in need of improvement by pastures, large country and plenty of water, small labour force, small population, wealthy customers at home and abroad, and conformity with the nation-wide growth of the livestock industry.

In this country, farming is carried on as a means of making money, not as a means of feeding people. The fact that some farm products achieve both purposes is a happy coincidence. Some products, e.g., wool, are useful despite being inedible, whilst others again are quite useless and/or toxic, e.g., tobacco, or are rendered so by processing, e.g., barley for beer. In much of the world, the main aim of farming is, however, to feed the farmer's family. Any surplus food is available for sale or barter or to pay rent and taxes. I am not advocating the adoption of peasant farming in Australia, only indicating that greater emphasis on food production is common in many irrigation areas in less fortunate countries.

The three paragraphs above show that Australian irrigation is small in volume and unusual in character. The questions immediately arising are:

- (1) whether new irrigation projects should be commenced to utilize our water resources more fully, and
- (2) whether the existing forms of production should be modified.

On the first point, realizing the precarious situation of the world's food supply, it is easy to answer yes, for humanitarian reasons. This answer, of course, only precipitates a further host of problems in economics, politics, and demography. The economist demands to know if money invested on irrigation works will draw as large a return on invested capital as the same money used for other forms of farm development in rainfall areas. He further wishes to know how sales can be made to people unable to pay the price that we set for our products. The politician is in a dilemma debating whether sales and/or gifts of food will secure friendships or strengthen a potential enemy or competitor. The demographer may insist that the problem is not too little food, but too many people, and that the adequate nutrition of today's population, without adequate reproduction control, will simply ensure a far greater food problem in another ten or twenty years.

It is not the intention of the writer to pursue the discussion of these and related problems in economics, politics and demography. As an agricultural scientist, it suffices to say that there is an urgent need for increased food production in the world and that Australia has large, untapped resources of land and water which may be jointly used for irrigation and the production of substantial quantities of food.

The remainder of this paper will therefore be confined to a discussion of whether the existing forms of production should be modified. As mentioned above, Australia is unusual in that a large proportion of the irrigated land is used to grow pasture. Actually, here in Victoria this tendency is found in the extreme, since 86% of our irrigated land is under pasture or fodder crops. In New South Wales, the other 'big' irrigation State, 60% is under pasture. There is certainly greater diversification of production in New South Wales, where many crops that are unknown in Victoria, e.g., rice, cotton, are grown, and where some 'new interest' crops, such as grain sorghum and maize, are receiving more attention.

Irrigated pastures in south-eastern Australia are grazed by cattle and sheep to produce milk, meat and wool. A dairy farm in a 14 in. to 18 in. rainfall area will yield, on the average, approximately 2400 lb. of milk, containing 80 lb. protein and 120 lb. fat, per acre-foot of irrigation water used. No other form of livestock production dependent on irrigated pastures can produce human food as efficiently as dairy farming; in fact, meat production is less than half as efficient.

Several crops, however, are capable of much higher water to food conversion efficiencies. An average wheat crop, for instance, should yield over four times as much protein per unit of irrigation water as dairying, whilst, in regard to energy (calories in food) produced per unit of water, wheat is at least seven times as efficient. Similarly, soybeans and sunflowers have conversion efficiencies at least two to three times those for dairying in regard to protein and fat, respectively.

The disciples of pasture and livestock will, of course, seek to nullify these apparent advantages of crops by pointing out that the success of the crop is substantially dependent on the work of a former pasture in improving both soil structure and soil fertility. 'Pastures build soil, crops destroy it.'

The concept of ley farming, so commonly practised in our medium rainfall areas, seeks to gain the monetary reward from frequent cash crops whilst interspersing pastures in rotation to maintain the health of the soil. Three factors that could tend in the future to increase cropping and decrease pasture in the rotation are:

- (a) Use of new minimum-cultivation crop-establishment techniques.
- (b) Use of cheaper nitrogenous fertilizers, thus ending reliance on nitrogen fixed by Rhizobia in pasture legumes.
- (c) Use of legume crops.

The possibilities for land use in non-horticultural irrigation areas are therefore:

- (1) Pastures entirely.
- (2) Pastures mainly, but occasional cash crops when regrading of land or cultivation and/or resowing of pasture is desirable.
- (3) Cropping mainly, but occasional pastures to minimize soil deterioration.
- (4) Cropping entirely.

In Victorian irrigation today, systems (1) and (2) are by far the commonest.

The fact that such alternatives are possible, however, has led to the initiation of experiments at the Irrigation Research Station, Kyabram, involving grain and oil-

seed crops. These were commenced in 1965, and crops showing some promise to date include winter cereals (wheat, oats), sunflowers, grain sorghum and possibly soybeans. Safflower has not done well, but its performance on lighter soils (off the Station) using pre-irrigation only could be a very different story.

The present series of trials is designed to identify suitable species and varieties and to determine appropriate cultural, irrigation and fertilizer treatments. Rotation trials will follow.

Farmers, of course, will not be impressed by how much food for human consumption is obtained from a particular crop or rotation, but only by how many dollars appear as profit. Thus, trends in market prices are as important as potential yields and costs of production in making farm management decisions. Present indications are that, during the next few years, prices for dairy products and wool will decline, whilst meat prices, particularly for beef, will hold firm. This suggests that some changes may occur in the proportions of the various species and breeds of livestock run on irrigated pastures, e.g., dairy cattle now utilize over half of the irrigated pasture in Victoria, but their proportion of the livestock population may decline as beef cattle increase. The actual trend in recent years has been for a slow increase in the relative importance of dairying amongst irrigation industries. The dairying industry has benefited by the newly-acquired ability of factories to manufacture a range of products from milk, e.g., butter, cheese, condensed milk, powdered milk, powdered skim milk, casein.

One immediate change in the next few years is sure to be an attempt by many irrigators, particularly dairymen, to increase stocking rates. When reduced water allocations in 1967/68 forced reductions in the area that could be watered, most dairymen found that near normal production could be sustained even on the lesser area of pasture. When normal irrigation conditions return, it should therefore be possible to graze larger herds on the normal area of pasture.

If the history of Victoria's irrigation over the past 40 years is accepted as our sole guide for the future, then clearly the only major change by the end of the century will be the addition of another million acres of pasture! Comparing, for instance, 1926/27 with 1966/67, one finds that, in this forty-year period, the area under horticulture and vegetables has increased by about 50,000 acres, the area under lucerne has declined by 70,000 acres, 'native' pastures have declined in area slightly also, but the area under improved pasture has risen from an almost negligible amount (10,000 acres) to over one million acres. This pasture now supports livestock whose annual production is worth \$100 million. The pasture itself, as a stock food (and the cheapest food available is pasture), is worth almost \$50 million per year.

Those who quote this rise of irrigated pastures as being indicative of an appropriate and profitable form of land use will no doubt have an economist explain to them that this is only so because the cost of the irrigation water is heavily subsidized by the State Government, and that very few irrigators would stay in business if their account for water increased by, say, \$2000 per year to meet the true cost of the water. Happily, such a rise is not likely to occur, for there are many sound reasons why governments should subsidize irrigation in this way.

A prediction based on historical evidence is therefore certain to suggest that further large expansions in the area of irrigated pasture in Victoria will occur. Water and land are both available, although the storage and distribution of the surface water involved may be more costly than in most existing systems.

A large new scheme recently proposed by the Mitchell River Water Utilization Committee requires the construction on the Mitchell River of a 1,660,000 acre-feet

storage reservoir to irrigate 200,000 acres of land (mostly pasture) between Stratford and Bairnsdale. This is but one scheme to utilize some of the millions of acre-feet of water that flow out of southern Victoria and into the sea each year. Underground water will also be used more for irrigation in the future. The exact quantity of underground water lifted for irrigation purposes in a normal year in Victoria is not known. It is probably less than 100,000 acre-feet, i.e., small in comparison with the water delivered by State Rivers and Water Supply Commission surface schemes. Twelve million acres in this State, however, are underlain by 'usable' (less than 4000 ppm Total Soluble Salts) water, but the ultimate safe yields of all such deep storages are not known.

The nature of development of our irrigation may also depend on the mode and extent of development in other places, especially in Northern Australia. Thus, for example, the rapid expansion of grain sorghum culture in New South Wales and Northern Australia, where conditions are climatically better for sorghums than in Victoria, would certainly reduce our chances of ever sharing in the supposedly large Asian market for this grain.

But there are many unknowns ahead. There are some who believe that foot and mouth disease cannot be kept out of this country indefinitely. If such a disease gained entry, an increased interest in cropping would immediately follow. On the other hand, economic advancement and improved living standards in Asia could create a huge market for Australian produce, including livestock products high in protein.

#### Summary

Victoria has a small but prosperous irrigation industry which is capable of enlargement and modification to yield even greater quantities of food. The same general terms apply to Australia. Although debate continues incessantly on the subject of the future population—food balance of the world, the fact remains that today some hundreds of millions of people are inadequately fed. Let us think of curbing food production only when everyone is as well fed as the majority of Australians.